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INTERVIEW OF EDWARD F. KNIPLING

BY LARRY QUINN

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WASHINGTON, D.C. 20003-2802
(202) 546-6666

MR. QUINN: This is an oral history interview with Dr. Edward F. Knipling. We're at his home in Arlington, Virginia, and today is March 9th of the year 2000. This interview is being conducted for Special Collections of the National Agricultural Library. I'm Larry Quinn with the Office of Communications at the Department of Agriculture in Washington, and I have certainly had personal benefit and observation of Dr. Knipling's work as an information specialist in Texas during the years when the screwworm eradication program was still active, and it is certainly my pleasure today, now to introduce to you Dr. Edward F. Knipling.

Dr. Knipling, it is certainly enjoyable to meet you and to hear about your career, and first, I want to acknowledge that in 1992 you were given the World Food Prize. Quite an accomplishment.

DR. KNIPLING: I certainly appreciate this honor. That's what's--what agricultural is all about, is food.

MR. QUINN: It certainly is, and one of the most spectacularly successful things that you did in agriculture, in the biological area, was to control or era-

-eradicate insect pests, and, specifically, the screwworm is one I'm familiar with.

DR. KNIPLING: Yes.

MR. QUINN: But you did this through the sterile insect technique and have totally eliminated this insect problem from the United States, now pushing it all the way through Central America almost.

DR. KNIPLING: Yes.

MR. QUINN: And, and tell us a little bit about that primary technique that you evolved. How did this come about? I mean, this is a, this is a wonderful contribution.

DR. KNIPLING: Well, it evolved gradually of course. I just didn't wake up over, the middle of the night or the next day, and--I, I--[coughing]. For years, I realized that, that the major insects at least that -we should try to prevent their damage, to begin with, rather than try to use some control measure after they've already appeared in, in damaging numbers.

So, in other words, the idea of, of trying to manage insects on an areawide basis is something that I thought about from maybe the beginning of my career in, in

entomology and, and this applied certainly for the screwworm, which of course was present in hundreds of thousands of square miles, and it, it would come in, into being at certain times of the year, and, and the idea of trying to control the screwworm in huge, large areas, by the use of insecticides, or, you know, just out of the question.

So I kept thinking about ways that we might deal with the screwworm in this measure, and I believe in the previous interview I discussed some of the, some of the factors that made that seem real--a reality.

MR. QUINN: Doctor, just give me a couple of those factors, just to refresh us about them.

DR. KNIPLING: Well, one, one was the, the knowledge that, that the screwworm, in actual numbers, existed at a rather low rate, and that gave me the idea that maybe we could rear enough screwworms that had detrimental characteristics, or like as later those that were sterile, to release and, and overwhelm the rather low natural population. Because a couple of our scientists had developed ways of rearing the screwworms in large numbers at a lower price, at low cost.

So that was an example of the logic that went into this, and then as it, the more I considered it for the screwworm, and years later, the more I considered it for other insects that were of major importance, and those that I had kind of taken a special approach or interest in, in trying to resolve and, and I kept thinking about ways that we might manage these on an areawide basis--total population management.

MR. QUINN: Well, I know from my own memory, that eventually that led to airdrops of sterile flies all over, for instance, South Texas, at the time that they were still, at least pushed down there. When did that start? I mean, how did that idea--was that the, the original way the insects were distributed?

DR. KNIPLING: [inaudible].

MR. QUINN: The airdrops of the sterile flies?

DR. KNIPLING: Well, we have to credit some of the specialists, like what they, what they produced. You know, they, they'd been developing ways of dispersing seeds, of crop planting seeds and crops, or use for herbicides or something, and I don't believe I emphasized in, in the previous interview, the, the tremendous

contribution that, that the pest managers made in, in making this screwworm program work. I mean, there were hundreds of people, contribute to this, and, and you have to credit them with developing a technology and, and to apply it successfully.

So they, they did a wonderful job.

MR. QUINN: So you obviously had a team of people who were rearing the si--the screwworms that would be delivered, you had pilots that would fly these flights.

DR. KNIPLING: That's right.

MR. QUINN: You had pest management people working with you. You say hundreds of people. How many people would have been--

DR. KNIPLING: Oh, yeah. Well, you know, just, you know, when they eventually, when they started rearing a 100 million screwworm flies a week, well, that was--nobody's ever reared insects in such numbers, and that took a lot of people to do that.

MR. QUINN: A lot of fluid for the screwworms, too.

DR. KNIPLING: And all the other things that they had to do to put the program into operation. So,

literally, I guess, in the 40 years or so, there's undoubtedly a thousand different people that contributed to that in the United States, Mexico. So it's a big operation, and a lot of people had important contributions to its development.

MR. QUINN: Well, during that period when the screwworm was being pushed out of the United States down into Central America, you were head of the Entomology Research Division of the Agriculture Research Service. What were your responsibilities as head of that, that division during that period, 1953 to '71?

DR. KNIPLING: For a number of years, I was chief of the, the section on insects that affect man and animals, and my experience had been along that line, and during the war we conducted research for the military people. But then I was promoted to a, to be a, eventually director of the Entomology Research Division, and therefore from that position I was responsible for not only insects affecting man and animals, but insects that affect crops and stored products, and, and all of the entomological problems.

So of course I had responsibilities in, in a wide ra--a wider range of insects, and so I devoted, began to

devote more of my personal time and efforts to, to trying to determine how we might be able to do a better job with insects like the boll weevil, and Mediterranean fruit fly, and from an international standpoint, tsetse flies, and so on.

So I, I gave a lot of thought to, to ways that we might achieve more effective control of these major insect pests on an areawide basis, and so the sterile insect technique was a useful technique for a number of other insects, but not necessarily for, for all of them. So I gave more and more thought to other ways and I think--actually, I think the greatest contribution that I have made to, to pest management is to recognize the potential of the par--parasitoid augmentation technique, which I don't--not many people even considered this as a, a way of dealing with insect pests on a areawide basis.

MR. QUINN: Meaning to, to raise parasites that would then--

DR. KNIPLING: That's right.

MR. QUINN: --attack those insects that are giving you a problem?

DR. KNIPLING: That's right. Most, most of the major insects pests that affect agriculture have, oh, some of 'em have two or three different parasite species, that develop almost entirely on this particular insect. For example, like the corn ear worm, or a European corn borer, and Mediterranean fruit fly, and some other insect.

So nature has given us the clues. Here, we've got wonderful organisms that nature created just, just to, to parasitize these insects. Now, nature, on the other hand, is not interested--I mean, na--Mother Nature is interested in protecting all its organisms and she doesn't recognize what we call destructive insects, or beneficial insects.

MR. QUINN: So a man--a scientist like yourself comes along to help that.

DR. KNIPLING: So that's our definition, not nature's definition. So with having all these wonderful organisms--but nature, Mother Nature has, has created for, with--there have been created biological and, and behavioral characteristics in both the parasitoids and the pests that keep, keep 'em within a rather narrow balance. That's part of the balance of nature.

MR. QUINN: You also--

DR. KNIPLING: Well, that, that balance permits enough of the pests to survive to, to cause more damage than we can afford; put it that way. Just that's just a simple, simple fact.

MR. QUINN: You mentioned several insects, a couple that you didn't mention I think that you probably worked with were like Gypsy moths and--

DR. KNIPLING: What?

MR. QUINN: Gypsy moths? Did you work with the insect programs there?

DR. KNIPLING: I did quite a bit of study with parasites of the gypsy moth. We could use parasites to deal with the gypsy moth too, if we'd only do it. It's--in fact most of the major insect pests that we could deal with--and I use the parasoid, parasitoid--and although I, I have so much confidence in the sterile insect technique, a parasite, a parasitoid augmentation technique, in my opinion, is ten times as effective as a sterile insect technique in terms of the number of insects that will be needed to control.

MR. QUINN: Well, and, actually, raising the sterile insects, there was certainly a lot of labor and a lot of feed--you had to feed the screwworms you were growing, so there's a lot of cost in, in the sterile insect technique.

DR. KNIPLING: Yeah.

MR. QUINN: Is cost another area you looked at as research in terms of using parasites rather than sterile insects?

DR. KNIPLING: What was that? I didn't get it.

MR. QUINN: Did you, did you evaluate the cost of using the sterile insect technique--

DR. KNIPLING: Oh, yeah; yeah.

MR. QUINN: --versus the parasites?

DR. KNIPLING: Yeah. Yeah, of course that's--that's basic to anything I did. If it's not cost-effective you can just forget it. Well, of course I don't think our agricultural leaders and many of the scientists today really fully appreciate the great potential that we have of dealing with insect pest problems, by, by just mass producing suitable parasites, parasitoids, or to modifying

the insects so that they are sterile or genetically deficient in some way.

The potential in my mind is, is just tremendous, outstanding, not only in, in terms of, say, dollars, but in terms of the environmental benefits of safety. These two techniques are virtually free of environmental hazards of any kind, and, and if you can control insects by environmentally safe ways, you avoid the, all this ecological disruption that has resulted from a dependence on broad spectrum insecticide for controlling perhaps--excuse me--90 percent of our agricultural insect pest problem.

MR. QUINN: The insects obviously sometimes become tolerant of the pesticides. You don't have to worry about that with the other techniques.

DR. KNIPLING: Yeah; that's right of course. Like you say, nearly all insects have developed resistance to one or more of these pesticides. Now I could argue, if I wanted to, if I thought it was the right argument, and so could many others, that insects might also develop resistance to the sterility technique or to, to parasitoids.

But I would say the chances are not one percent as great that insects can develop resistance to these two biological procedures as they would develop resistance to chemicals. That's, that's my, my viewpoint.

MR. QUINN: The final job you held in your career was science advisor to the director of the Agricultural Research Service. During that period, you got to move to even yet a more global level where you were making proposals about research.

What would you say would be the most important things you did during that period as a science adviser?

DR. KNIPLING: Well, I kept trying to needle our agricultural executives as to, to get more funds for research--that could focus on this, and after my retirement, that's the main, the main objective I had, is somehow or another, to get more support for scientists to do research on these, and I don't know, how many special memoranda I'd written to the administrator of the Agricultural Research Service and to the Secretary, in some cases, suggesting that more research be conducted on this. Maybe the, the sterility technique for other insects, or

the parasitoid augmentation technique for the boll weevil, the Mediterranean fruit fly, and so forth.

So I, I devoted an awful lot of effort to try to, first of all, analyze the potential of some of these techniques for these various insects, and I wrote papers on some, and others I just maybe wrote a manuscript and, and submitted it to a few people, and, you know, to get their attention.

And I think it helped but, but you know it's--in spite of a great potential, you'd be surprised how much opposition there was to try to deal with these important insects by these, some of these other measures. Why, I don't know. I had difficulty--you take a boll weevil, for example.

I--from the time that--of course I knew the boll weevil from the time I was on the farm, you know, and could see how much damage the boll weevil could cause, just like I'd seen that for the screwworm.

So I was interested in the boll weevil, even before I ever went to college. So I spent a lot of time thinking about boll weevil, and I was one of the proponents--there were, there were a dozen, or more, that

said let's try to find out some way to eradicate the boll weevil, get rid of it.

Well, you know, we used the term eradication. For some people that's, that's like waving a red flag. I mean, they're opposed to the idea of eradication for various reasons, and some of which don't make much [inaudible].

They talk about upsetting the balance when you eradicate a pest. But they don't consider how much the presence of this pest has upset the balance, to begin with.

So if you can get rid of a pest like the boll weevil or European corn borer, or Mediterranean fruit fly, or--and I'd say that the most, the most damaging insect pests that we have--and I'd say those are responsible for perhaps 80 percent of the insecticides used for agricultural purposes, are alien pests that came to this country and became established, and those, in particular, are the ones that I thought that we should make a more determined effort to find ways to manage them without the need for insecticides and at lower costs.

MR. QUINN: What were some of the ways you tried to eradicate the, the boll weevil?

DR. KNIPLING: Yeah. Well, of course one of the big disappointments I had, when we had established a--expanded a boll weevil research program, and boll weevil, got the boll weevil laboratory down at--in Mississippi, I was on the committee that--a committee of about five, that went around to interview different locations where we might establish this laboratory and get some ideas on the type of control procedures that might be emphasized. But of course by that time we'd, we'd made an awful lot of progress with chemical insecticides to control the boll weevil.

But I was also interested, in a lot of ways, the sterility technique, I figured that could work in, the use of boll weevil attractants or pathogens. In other words, there were more opportunities than just insecticides.

But growers relied almost entirely on the application of insecticides, not only for the boll weevil but a dozen other major insect pests, in the whole country, in the whole world, for that matter, just started, "Well, let's--here's a bug, now let's find a chemical to control it." That was, that was, I'd say, 75 percent or 80 percent of the, the world effort in dealing with insect pest problem.

So there was relatively little support, for a long time, in these alternative ways, except when we got to see some of the problems, as valuable as they were, and they were of untold value for agriculture and of course for health; but despite their tremendous value, they caused another, awful lotta problems.

MR. QUINN: You did field trials and, and experiments--field trials for the boll weevil control?

DR. KNIPLING: What?

MR. QUINN: Did you do field trials in a variety of these methods?

DR. KNIPLING: Yeah. That was, that was one of the things I, I pushed for, and have pushed for for other insects, is I recognized this: you're not going to get farmers to pay for a certain program unless it will do the job and will do the job at less cost, and he can do it by the use of insecticide. You can do all the writing and talking you want, but unless, unless he can do that, you're not going to get farmers to, to pay for those programs. That's their livelihood. It's a profit and loss deal for them, so--I've always argued we've got to have what I call

[inaudible] to prove to skeptics, prove to the farmers, prove to the public that this is a better way of doing it.

And I was, along with others, successful in getting these two pilot tests for the boll weevil, one down in Mississippi--the dates, I'm never good at dates--but anyway, a large-scale test down in Mississippi about, oh, I'd say the middle '80s, or sixties. And we had a large technical committee appointed and I was chairman of, of the research aspects, and Jim Brazil [ph], who was with APHIS.

MR. QUINN: What kind of work--obviously he was representing the APHIS or the Animal and Plant Health Inspection Side and you the research side.

DR. KNIPLING: Yes.

MR. QUINN: So how did you tackle this together?

DR. KNIPLING: How did we tackle it together?

MR. QUINN: Yes, sir.

DR. KNIPLING: Yeah. Well, there's always been a need for cooperation of course between the research people and the, and the control people, action people, and it's just a logical type of cooperation, and, and you have to have cooperation between the federal units and the state units, and, and the industry, and it takes, it takes a lot

of maneuvering, you might say, consideration, to develop a, you know, a large program like that.

MR. QUINN: How long a period did you work together on this project? Was it for several years?

DR. KNIPLING: Oh, yeah. Yeah. I knew Jim for years, even before we got associated with boll weevils, but mostly the boll weevil. I'd say that 15 years or so, of a period of time. In other words, it was nearly always the boll weevil, he was number one on boll weevil too.

MR. QUINN: What do you think was the most effective technique with boll weevil, or maybe even still is today? What, what do you consider the most effective against the boll weevil?

DR. KNIPLING: Well, I tried to get our own scientists and control people and others doing everything that I possibly can, to try to get more interest in the use of boll weevil parasites as a means of not only controlling but for eradicating the boll weevil, and that's something I'd like to mention for the record, is that the sterile insect technique just did not work very well against the boll weevil.

It's a long story, why, but, but the main reason is that the irradiation has adverse effects on the vigor and competitiveness of the sterile male. They're not normal. I doubt if they're 20 percent competitive, and that's just not competitive enough to make it a very effective way.

But I figure that they've got boll weevil parasites, that scientists had, had discovered, that are highly specific for the boll weevil and that are very effective.

MR. QUINN: Well, you've obviously used a variety of techniques, the sterile insect technique, and then of course the parasitology to, to do that. What have you done in your post-career work? You, you retired in 1973 but you've been very active since that in, in the past 17 years, to kind of help the--

DR. KNIPLING: Well--

MR. QUINN: --respect for the beneficial insects that are around.

DR. KNIPLING: I--I kept working on the, the areawide concept, sterile insect technique, tried to get it used for more insects. But I think probably my greatest

contribution was the work I did on how we could use insect parasitoids in the same way to manage and eradicate insects, and so I wrote a book on that, on the use of parasitoids, and I think it's by far the best and most important contribution that I have made to the area of pest management.

But for reasons I can't understand, it just is not, was not accepted by the scientific community to the degree that I thought it should have. A few, a few scientists started working on it, and they made some important contributions. But it was always on too small a scale. You can't use these techniques, either one of these, to deal with insects in a, on a farm by farm basis, or, or habitat by habitat basis. You have to use it to deal with insects on an areawide basis.

When you use it in that way, there's no other methods that offer, that can be as effective, that can be as low in cost because the lower the pest population, in these two techniques, the fewer the insects you need to control it, and that means lower cost, so that's simple, a simple fact.

MR. QUINN: And the cost to the farmer is such that they have to do it on an areawide basis to afford it.

DR. KNIPLING: Yeah and that means you have to have these organizations. That's where you run into--obstacles.

MR. QUINN: And so you, you've had lots of obstacles to the scientific research that you've done through--

[Simultaneous conversation.]

DR. KNIPLING: [inaudible]. It's amazing.

MR. QUINN: But--

DR. KNIPLING: They're still there.

MR. QUINN: Yes.

DR. KNIPLING: They're still there. They have to be broken down, somehow.

MR. QUINN: But nevertheless, you have made marvelous progress on such pests as screwworm and--

DR. KNIPLING: Yeah. When you look at it, the one perspective, there's been a lot of problems. But when you look at it from another, it's been minimal compared with the potential. That's the way I look at it. But all

of this eventually, I'm confident, eventually they'll see the merits in it.

MR. QUINN: Where would you like to see research go today, from, from this point where you have brought the scientific technique? Where would you like to see it go in the 21st Century?

DR. KNIPLING: Well, we need, we need the farm to farm, or if you want to call it the IPM system, you need that for a lot of insects. But I've used different numbers for this. But I would say conservatively, that 75 percent of the major insect pest problem, those that are, cause 75 percent of the, the damage, those that cause use to 75 percent of the insecticides, I'd say at least 75 percent can be controlled more effectively, at less cost, and from a, a ecologically safe manner, by the use of those two techniques, one or the other or both, than, than can be done by any other way.

So--and the, the parasite augmentation technique, as I believe I mentioned earlier, I figure is much more effective than the sterile insect technique. But there's an advantage to using both of these techniques at the same

time. It's, results in, in what I have termed as mutual synergistic suppressive action.

In other words, the one technique enhances the effectiveness of the other.

MR. QUINN: What about the release of the hybrid sterile strains? Did they have any? The hybrid sterile strains--do they have any impact on this as well?

DR. KNIPLING: Yeah, if you can get--if you can get hybrid steriles that are satisfactory, it could have some advantage. But I don't believe they've done enough work on that. I believe that--I believe they could have developed sterile boll weevils, and maybe gotten, eliminated this serious damage, you know, that I had mentioned earlier. But you know it's, it's so hard to, to get people to put the money and resources, and the interest to do all these things. That's, that's the obstacle, and I can see why--but I can't understand why our agricultural leaders, and both in the public and private sectors--I can't understand why they cannot see the justification for a major research effort along this line, and, you know, controlling pests and the environmental hazards is one of society's biggest problems.

You know, we, we have so much--so much trouble getting the, the, you know, few millions of dollars. For example, I, I--I estimate that if they would have 25 million a year, that is focused on areawide management procedures--and that would include the parasite augmentation, the sterility technique, and, and insect--sect's pheromone, I would say that that would be all the need, research you would need to develop this technology to the degree that you would expect.

But if they would accomplish what I feel confident they could accomplish, it would--agriculture would benefit in the United States alone, I figure by as much as $5 billion a year, would get rid of most of the environmentally hazardous insecticides, and, and consider what, how many investments in research or otherwise, that you make, and what you could expect--to get a hundredfold return. You name 'em. They're not many. But I'm confident that this would be the return, if society would do that.

MR. QUINN: Did you use viruses of pests, at all, in, in some of the work? Viruses on pests? Did you try viruses on pests? How, how--

DR. KNIPLING: Yeah.

MR. QUINN: --successful were they?

DR. KNIPLING: Well, that's a--that was another area that I thought that deserved a lot of attention, and say "pathogens" as we call them, and it--they do. But, unfortunately, most of 'em don't do the things that insecticides do. Those pathogens are usually kind of slow in action. It may take two or three days, and maybe even longer, after you apply 'em, before you start controlling insects.

Now after a grower decides that he has to control this, he can't--he doesn't want to, and he can't afford to wait a week. He's got to have something to do it, and that's the reason they like insecticides. If you have a pest that, could be controlled by applying a virus, that it may work very well, but in a week. But it won't do what an insecticide will do within two hours after you apply it. So that's, that's the main reason.

MR. QUINN: So do pesticides have a role in the long-term management? Obvious--

DR. KNIPLING: What?

MR. QUINN: Do they have a role in the long-term management--

DR. KNIPLING: Oh, yeah.

MR. QUINN: --together with some of these--

DR. KNIPLING: Yeah.

MR. QUINN: --other techniques?

DR. KNIPLING: We'll need 'em, and I'm--I don't, in any way, try to condemn the importance of pesticide, insecticides. Just look at the, what it has meant for human health. We have control of malaria, typhus, dysentery, and, you know, AG. I mean, it's tremendous. Look at all the billions that farmers have saved in having these insecticides. But that does not mean that--dependence on these has been a costly thing, and there's no--I can't see an end to it. I can't see science developing safe insecticides that will do what the broad spectrum--I just can't see it. I don't think it's there.

You have the problem like insects develop a resistance. You have the cost factor, that it costs about as much to control a low insect population as it does to control a high population. So you're not going to get farmers to spend money controlling an insect population

that exists below a significant damage level. They're gonna wait until the insect has to be controlled. That's just, just plain and simple logic, see.

But if we can use preventive measures, like the release of parasites or, or sterile insects. When the insect population is low, and it costs one-tenth as much to keep it from causing damage, than it would cost to control it, then that's when you get people interested. But you've got to demonstrate that this can be done. That's the rub.

MR. QUINN: Yeah.

DR. KNIPLING: That's the thing that I've tried so hard to overcome, and I just haven't done a lot to overcome it, and I'm not alone in this. There, there are a number of proponents of the areawide concept, and I predict that some day, it will be adopted, more and more; but it'll take time. It'll take some outstanding leaders to take the position to do it. You know, to push--but, again, you're going to have to demonstrate it, and you're going to have to have certain millions of dollars to develop the, say, [inaudible] procedures to demonstrate, and those are the hard ones. It's the 25 million that I'm talking about, that it's hard to get.

In my opinion, the technology, we either have it or could have it, to do all the things that I'm talking about.

MR. QUINN: So hearing you speak, it sounds to me that for you as a researcher, the dilemma is not necessarily being unable to find the answer. It's unable to find the research funds to find and develop those answers.

DR. KNIPLING: That's right. I agree. I feel that way, stronger today than I did ten years ago or twenty years ago.

MR. QUINN: So you think it extends the time for--

DR. KNIPLING: Yeah.

MR. QUINN: --us to find these important answers.

DR. KNIPLING: Yeah; that's it. You've--you stated it right. That's it.

MR. QUINN: Hearing you talk about use of a variety of techniques and pesticides, that means then that the integrated pest management approach is the way we're headed for the future, or not?

DR. KNIPLING: I didn't get that.

MR. QUINN: The integrated pest management approach, is that the answer, then, since we need--

DR. KNIPLING: No.

MR. QUINN: No?

DR. KNIPLING: Not the way it's conducted.

MR. QUINN: So it needs some change?

DR. KNIPLING: Integrated pest management is a good management system but it will not do what I said. They will not--you cannot develop these areawide management procedures with integrated system. Integrated system is based on establishing economic treatment threshold, and wait until the insects get there, and then, then invest your money. They talk about integrated pest management and integrating biological procedures with the chemical procedures. But when you go down the list, when you take 25 major insect pests and see what they actually do, there's not much integration.

It's 90 percent applying an insecticide. That's how much integration you get.

MR. QUINN: So what are the factors that help you bring into practice an areawide treatment program? What,

what are the important things of an areawide treatment program? What, what makes that work?

DR. KNIPLING: Well, it's--it'd take me 30 minutes to explain all the factors. But the, the sterile insect technique and the parasite augmentation technique are two techniques that become increasingly effective with the declining pest density. Now that's a key factor. The lower the pest density, the fewer the sterile insects or parasites that you would have to rear and release to keep that population low.

MR. QUINN: So the further you get, the less it costs?

DR. KNIPLING: That's right. That's--you know, people don't realize that, but, but that's true. Absolutely. With those two techniques. I put it this way. I'm sure I'm right. If you were trying to get rid of an insect by the use of insecticides, it will take as many of our insecticide applications to get rid of the last one percent than it does to get rid of the first 99 percent.

I think I can back that up. I think most people that, that use insecticides for control purposes would support that statement. But if you're using sterile

insects or parasites, it would take only one-hundredth as many insects to get rid of, say, one percent, as it would take to get rid of the first ninety-nine.

So you put those two together, you factor those two, and you can see the advantage in some cases of integrating those two systems.

But once you get the insect population down, if you can get rid of it, fine. But you can't get rid of all these. You get it down so low, that it causes no damage, it costs very little to keep 'em low. Just take like, like a corn borer, for example. Say there's 40 million acres of corn in the Midwestern region.

I believe most authorities will agree that, that the European corn borer, on average, costs growers about, say, $25 per acre per year, on the average, in that whole region. So there's a billion dollars of damage.

But, you know, if you could get the corn borer population down to one percent of its normal level. I'd say you could keep it down at, at a cost of one dollar per acre.

MR. QUINN: Wow.

DR. KNIPLING: That's the level. That's what I'm trying to, trying to sell. But I, I have trouble selling that. But it, it will take a great deal of research to develop the technology and to demonstrate that it will perform, and that's where the, that's where the obstacle is. I--that would apply, not only the corn borer but a dozen other insects. Same, same problem.

MR. QUINN: You have received a lot of recognition for your work down through the years, and rightly so, for the, the tremendous advancements that you've made in research. What gave you the most satisfaction of some of those recognitions?

DR. KNIPLING: Well, I've, I've received a lotta recognition. I sometimes think I received more than I deserved, because in all these, it took the help of many scientists.

MR. QUINN: Well, this one was a very important one [points to World Food Prize on table]…

DR. KNIPLING: Yeah.

MR. QUINN: --with you and Dr. Raymond Bushland.

DR. KNIPLING: Yeah; that's right. Well, I'll tell you, some of the things that, that--all these years,

that, that I say received most satisfaction, the first one that was really outstanding was when our Dr. Baumhover and Dr. Bushland, and others who were conducting the, the study on the island of Curacao, when they sent in their reports, for about the first six weeks, and the results were following exactly about like the model that I had developed, that it should work.

MR. QUINN: So the reward is seeing your, your ideas come true.

DR. KNIPLING: That's true. There were tremendous satisfactions. Another outstanding, I mean, thing that I felt proud of was, you know, a great controversy that developed over the boll weevil eradication program, and the difficulty that was involved in trying to get an eradication program approved. It didn't come easy. I mean, there was opposition--strong opposition.

You take like the National Academy of, of Sciences. You know, they made a study and set up a panel to see whether or not to recommend the boll weevil eradication program.

MR. QUINN: Dr. Knipling, you were telling me, a minute ago, about the, the controversy that evolved over the research solutions for the boll weevil.

DR. KNIPLING: Yeah.

MR. QUINN: Tell me that again.

DR. KNIPLING: Well, the, the idea of trying to eradicate the boll weevil was kind of a long, controversial issue. There were people who said that it could be done and there were people said there was no chance. So you had that.

Well, I was one of the, the people that took the, the optimist view, and we had this research program that was, was focused on eradicative measures.

So the scientists, like Ted Davage [ph], Dr. Davage, and the work that Brazil [ph.] was doing, and others, when we got to the point where we thought it'd be worthwhile to run the pilot test-- and that was run. And I thought, I thought it was a success. But we just did not conduct it on sufficiently large scale, to show that we could eradicate the boll weevil from the whole area. We had about a 50 square mile area.

But, to me, and to others, it was a great success. At least the cotton that was 25 miles isolated from other boll weevils, they could not find any boll weevils in the cotton. Those that they found were more than twenty-five--I mean less than twenty-five.

Well, since it was controversial to begin with, you can be sure that those that were opposed insisted you had not proven you could eradicate the boll weevil. So it became an issue. It became an issue not, not just among agriculturists but the whole scientific community. So I argued that we should run another experiment on a larger scale, where there's more isolation.

And fortunately, Dr. Bulhearn [ph], who was head of APHIS at that time, used his, his efforts to get some funds for another pilot experiment. So to make a long story short, he was successful in getting that. So a pilot experiment was run in North Carolina. We had better isolation and where there was about maybe 20,000 acres of cotton involved. It was a big experiment.

Well, to me, and most of our research people, that was also a successful experiment. But the opponents used every argument they could to say you still haven't

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proved that you could eradicate the, the boll weevil. It ended up getting a committee appointed by the National Academy of Sciences, as to consider whether to recommend an eradication program be undertaken. They, they appointed a committee.

When I saw the members that were on that committee, my impression was that it was a stacked committee, to begin with. I say this because I sincerely feel that. This review committee had no members from the U.S. Department of Agriculture, for example.

They had no members on the committee that had been developing the technology. Now can you imagine anybody making an objective analysis without having the expertise that was needed? But that was their policy.

Well, to make a long story short, they came up with some real--I say they scraped the "bottom of the barrel" to try to find reasons for saying that that experiment was not successful, or to justify an eradication experiment. I won't, I won't go into details on, on this. I think I made my comments at the time, and there's a record for it, but I doubt if, if many people had seen it--my comments.

But despite the recommendation against it, there was enough support from the cotton industry, and I hope that, that our scientists felt that they got Congress to approve an eradication program to start with North Carolina and South Carolina. That was saved.

Well, that wasn't as large as it should a been, but at least that was--they were successful. and I'll say one of the greatest satisfactions I had in all my career was when they announced that they had eradicated the boll weevil from North and South Carolina.

MR. QUINN: Widely so.

DR. KNIPLING: Happened. A tremendous satisfaction.

MR. QUINN: You know, you've had worldwide recognition as well in Japan. In 1995--

DR. KNIPLING: Yeah.

MR. QUINN: --you received a worldwide recognition.

DR. KNIPLING: Yes, I--

MR. QUINN: Tell me about that.

DR. KNIPLING: I, I received tremendous credit from the Japanese scientists and gentlemen. They, the

Japanese took advantage of the sterile insect technique and conducted a, a program to eradicate the melon fly from the Okinawa islands, a series of islands. Well, this proved to be very successful. The melon fly was preventing 'em from having a, a really thriving vegetable and fruit economy because they couldn't ship their fruits and vegetables to countries that were afraid of importing the pest. That's those--that's one thing that they do for a number of insects.

Well, they, they under, undertook a program, got rid a the melon fly, and all their scientists tell me that it improved the vegetable economy on those islands at least 200 million a year. Well, that's, that's a tremendous boost for agricultural economy. Any recognition of that--they--I was awarded their, what they call the Japan science and technology prize. They have one every year, and it's for different purposes. But some years it's for agriculture and--but the year they had it for agriculture, I was selected for that. Well, that was a tremendous recognition.

MR. QUINN: Further validation of your work with the--

DR. KNIPLING: What?

MR. QUINN: Further validation, worldwide--

DR. KNIPLING: Yeah; that's right.

MR. QUINN: --of the sterile insect technique.

DR. KNIPLING: That's right. Yeah. That was--that was a real honor. Besides the $500,000 that went with it.

[Laughter.]

MR. QUINN: That makes it nice.

DR. KNIPLING: Yeah. But now that was very satisfactory. I had some other satisfactions. The World Food Prize is one, and, you know, it's a strange thing that--I'll bet you 90 percent of our young children don't really appreciate where our food comes from. They think it comes from the supermarket, which it does; but they don't know all the, the work, the costs and the risks that a farmer does to produce all that wonderful food.

They, they, they don't fully appreciate. In other words, they don't, they really don't--our society really does not appreciate what agriculture has done for, for people that are producing all this wonderful food.

So to get recognized for that was a tremendous satisfaction.

MR. QUINN: As we have entered the 21st Century now, are you encouraged about reaching the level of pest control that you always aimed for?

Are, are we getting closer?

DR. KNIPLING: Yes. I'm encouraged; but it's coming slow. Now I, I can't still understand why it's so hard to try to get this, something like this implemented. Cause I read in several reports, in several papers, and I--it's being recognized by more but it's still awful slow. But some day it will, because they'll know--I cannot foresee any alternative, that can even come close to achieving what could be done by the areawide approach using parasitoids and sterile insects together, and those two, when you put 'em together you get a real boost. I believe I mentioned that earlier.

MR. QUINN: Well, Dr. Knipling, I want to thank you for this opportunity to be in your home today. This is March 9th of the year 2000.

DR. KNIPLING: Well, I feel honored.

MR. QUINN: And for, and for the boost that you have given agriculture research.

DR. KNIPLING: Yes.

MR. QUINN: I'm Larry Quinn with the Office of Communications at the Department of Agriculture. This interview has been for the Special Collections of the National Agricultural Library.

[END OF TAPE RECORDING.]